

# Captive Care and Husbandry of Ball Pythons (*Python regius*)

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**ABSTRACT:** The ball python, *Python regius*, is known for its docile demeanor and unique protective mechanism. This native West African species is relatively simple to care for, making it a popular snake among first-time reptile keepers and hobbyists alike. Natural history, husbandry, and common health problems are reviewed in this article, which is intended to supplement discussion between the veterinarian and client.

**KEY WORDS:** *Python regius*, ball python, royal python, husbandry, reproduction, anorexia.

## INTRODUCTION

*Python regius*, commonly known as the ball python or royal python, originates from west and central Africa. This docile python's range extends along the western coast of the continent from Sierra Leone, Ghana, and Liberia to Nigeria and across equatorial regions as far east as Uganda (Mehrtens, 1987; Murphy *et al.*, 2003; Aubret *et al.*, 2005). Interestingly, the natural range of the ball python does not extend south of the equator (Sutherland, 2009). Ball pythons prefer grassland, savannah habitats, and farmland, most often inhabiting rodent burrows or abandoned termite mounds (Murphy *et al.*, 2003). Multiple pythons may inhabit the same burrow, except brooding females, which are more likely to be found alone. Ball pythons hunt and move most often at night and tend to remain stationary in their burrows during the day. Exporters take full advantage of this knowledge by collecting eggs, juveniles, and, less often, adults during the day as they rest in their burrows (Sutherland, 2009). Although captive breeding has become commonplace among reptile enthusiasts across the United States and Europe, thousands of wild-caught ball pythons continue to be exported each year (Luiselli *et al.*, 2012).

**Special characteristics:** Ball pythons are heavy-bodied, muscular snakes with slim necks and narrow heads. Typical wild-type ball pythons sport a background color of medium to dark brown, with overlying lighter brown to yellow patches or bands. The pattern and shade of each wild-type individual is slightly different. These differences have been exaggerated through multiple generations of captive breeding to create dozens of unique color and pattern morphs.

Ball pythons live an average of 20–30 yr in captivity, although some have reportedly lived over 40 yr (Funk, 2006). Male ball pythons reach sexual maturity at 12–18 months, whereas females mature later, at 24–36 months (Murphy *et al.*, 2003). In the wild, the breeding season extends from November to January (Aubret *et al.*, 2005). In captivity, ball pythons are thought to be reproductively active September through February, with females laying eggs February through August (Ross and Marzec, 1990). A more recent study suggests that captive breeding can and does occur during any month of the year (Morrill *et al.*, 2011). Average clutch size is two to eight eggs.

Several anatomical characteristics separate snakes, including ball pythons, from other members of the order

Squamata. Five labial pits can be found on either side of the ball python's mouth. These pits sense heat or infrared radiation and are used most frequently to detect prey items (Sutherland, 2005; Funk, 2006). Second, a ball python's eyes lack eyelids. The eyes are covered instead by a thin, transparent scale, known as a "spectacle". This spectacle should be shed regularly with the rest of the skin but, in certain conditions, can become adherent to the new spectacle (see Grooming and Handling and Dysecdysis) (Funk, 2006; Rowland, 2011). Moving more caudally, two "spurs" can be found near either side of the python's vent. Spurs are found on both males and females and are thought to be vestigial pelvic limbs. Spurs are used by males for gripping during copulation.

**Size:** Newborn ball pythons measure 25–35 cm (10–14 in) in length. Adults typically reach 1.1–1.5 m (3.5–5 ft) in length, with females growing larger than males. Some may approach 1.8 m (6 ft) in length (Murphy *et al.*, 2003). Breeding adults may weigh 1.5 kg (3 lb) or more, with large specimens weighing as much as 4 kg (9 lb) (Sutherland, 2005).

**Temperament:** Ball pythons are very docile creatures that are generally reluctant to bite. Most will choose to curl themselves tightly into a ball rather than strike out when feeling threatened, hence their namesake. Adults may grow out of this defensive behavior with regular handling (Bays *et al.*, 2006). Bites are most often experienced when a handler attempts to hold prey in front of the python's face. Because ball pythons rely at least partially on heat sensing pits to locate prey, the handler's hand may be targeted rather than the prey item.

## CAPTIVE CARE REQUIREMENTS

**Temperature:** In the research setting, ball pythons have traditionally been maintained in ambient temperatures of 25–30°C (77–86°F) (Waas *et al.*, 2010; McFadden *et al.*, 2011; Nielson *et al.*, 2011; Banzato *et al.*, 2012; Christensen *et al.*, 2012; Enok *et al.*, 2012), with some given basking zones of 32–35°C (90–95°F) (McFadden *et al.*, 2011; Enok *et al.*, 2012). Published guidelines for captive ball pythons recommend an ambient temperature of 28–30°C (82–86°F), a basking zone of 35°C (95°F), and a nighttime temperature of 22–26°C (72–79°F) (Divers, 1996; Mitchell, 2004; Rowland, 2011). Some sources suggest that mating success may

be increased by decreasing the ambient temperature of a ball python's enclosure by 5–6°C (10–12°F) for a few weeks prior to pairing males and females (Ross and Marzec, 1990; Sutherland, 2005, 2009). A basking zone should still be provided during this time.

Basking zones and temperature gradients can be created with the use of heat lamps, ceramic heaters, and under-tank heaters. Temperatures should then be measured daily through placement of thermometers or temperature probes within the enclosure or by the use of an infrared thermometer or "temperature gun." To reduce the risk of thermal burns, care should be taken to ensure that snakes do not have direct access to the heat source. Even without direct contact, ball pythons that burrow are more likely to burn themselves when resting near under-tank heaters. Therefore, if this type of heat source is used, one must take extra care in monitoring the animal.

**Lighting:** Although controlled studies are scarce, it has been suggested that full-spectrum lighting should be provided to ball pythons. Full-spectrum lighting is designed to simulate natural sunlight, particularly providing rays in the visible and ultraviolet (UV) spectra. Ultraviolet B (UVB) and ultraviolet A (UVA) may influence mating activity and reportedly provide behavioral and psychological benefits (Divers, 1996; Mitchell, 2004). Although UVB light has been found to be important in the photobiochemical synthesis of vitamin D<sub>3</sub> in several reptile species, including corn snakes (*Pantherophis guttatus*) (Acierno *et al.*, 2008), it has not been found to be important in ball pythons (Hedley and Eatwell, 2013).

Photoperiods should simulate that of a species' native habitat. Given the ball python's equatorial origin, a 12 h day/night cycle is recommended. Some choose to alter the photoperiod seasonally when mating behavior is desired, but this is not necessarily required. Timers should be used to ensure that captive ball pythons experience consistent and appropriate daily photoperiods. Snakes that do not experience regular day/night cycles may become stressed and develop secondary health problems (Mitchell, 2004).

**Humidity:** Ball pythons require only moderate humidity. Published recommendations suggest maintaining humidity at 50–80% (Divers, 1996; Rowland, 2011; Sutherland, 2009). Ball pythons housed in research settings have been maintained at 60–70% humidity (Waas *et al.*, 2010; McFadden *et al.*, 2011). A humidity gauge should be used to ensure correct levels are maintained. Gauges are inexpensive and readily available in all major pet product retailers. If room air is not adequate, humidity within the enclosure can be increased by misting daily with water or by placing a water dish near the heat source.

**Water:** Clean, fresh water should be available at all times. Provide a dish that is large enough for the snake to submerge itself without spilling water over the edge of the bowl. Commercial water bowls can be used, as well as plastic storage containers, dog bowls, or plant saucers (De Vosjoli, 1999). Ball pythons will choose to soak themselves periodically to aid with ecdysis, drinking, and defecating. The water should be checked daily and changed immediately (and bowl disinfected) if the water is soiled. Even if the water appears clean, it should be changed at least once every two to three days.



**Figure 1.** Two adult ball pythons, *Python regius*, in their enclosure. This habitat is of appropriate size, contains water bowls large enough for soaking, provides multiple locations for hiding, is constructed of durable material that is easily cleaned and offers a clean, safe substrate. Photo courtesy of Jackie Bruce, DVM.

**Enclosure:** Because ball pythons are a ground-dwelling species, a long enclosure is preferred over a tall enclosure (Figure 1). Caging should be made of sturdy, nonabsorbent material, such as glass, plastic, Plexiglas, or a soft mesh screen. This will reduce the likelihood of injury related to housing and will be easier to clean (De Vosjoli, 2009; Funk, 2006). One should provide a minimum 0.6 m<sup>2</sup> (2 ft) of space for a ball python measuring 1 m (3.3 ft) in length, but an enclosure double this size is ideal (Divers, 1996).

Numerous varieties of commercial and custom enclosures are available for purchase in stores and online. The ideal choice will depend as much on the safety and size of the enclosure as on the purpose. Rack style housing, which consists of columns of plastic drawers suspended on tracks or shelves, may be most appropriate for breeders because of its simplicity, ease of cleaning, and capacity to house numerous animals in a small space. Glass tanks or more complex vivaria may be most enjoyable for those wishing to display ball pythons for educational purposes or pleasure.

**Substrate:** Numerous substrate choices are available. A good substrate should provide an adequate level of safety, be easily cleaned, and complement the desired aesthetic (Rossi, 2006). Newspaper, butcher paper, and artificial carpeting are safe, easily cleaned, and are excellent for herpetoculturists with large collections, in hospital settings, or for those who prefer a very low maintenance enclosure. Bioactive substrates are a second, very attractive option for snakes in most settings. A bioactive substrate contains bacteria and other active microorganisms that break down fecal material in the enclosure, balance out moisture and nutrient levels throughout the substrate, and help maintain healthy plants within the vivarium (De Vosjoli, 2004). This substrate typically contains a mixture of numerous substrate bases, such as peat moss, potting soil, finely shredded bark, sand, and clay. Once the microorganisms are established, the substrate requires little more than a weekly stir, some spot cleaning, and the addition of water (De Vosjoli, 2004).

Many one-step, ready-to-use substrates are available through pet stores. Aspen and cypress wood shavings provide a somewhat natural look, are generally safe, and are easy to clean. Pine and cedar shavings contain aromatic

compounds that are potentially irritating to the respiratory system and, therefore, should be avoided (Mitchell, 2004). If wood shavings are chosen, the python should be removed from the enclosure for feeding to prevent it from inadvertently ingesting the substrate. Sand, loose dirt, and walnut shell are also readily available but are not ideal, except within the context of a bioactive substrate. These small particles can lodge around the eyes, labial pits, mouth, and nares, creating a variety of health problems.

**Cage furniture:** Cage design should emulate the ball python's natural habitat and be easy to clean. Ample space should be provided for hiding to satisfy the snake's natural desire to rest in burrows. A minimum of two hiding boxes or logs should be placed in the enclosure. One should be available near the heating source and the other placed at the cooler end of the enclosure. Placing multiple hiding spots along the enclosure's temperature gradient will allow the snake to rest more comfortably in any desired temperature zone. Commercial hiding boxes can be purchased at any major pet retailer. Homemade hiding boxes can be made from plastic storage containers or water/food dishes of sufficient size. Holes can be cut to allow for easy access, provided no sharp edges are left behind.

Smooth rocks, sturdy plants, and branches can also be provided as decoration or to supplement hiding areas but are not required. Live plants can be used as long as they are nontoxic and are sturdy enough not to be damaged by the movement of a heavy-bodied snake. Branches should be wide and well secured. Every component of the enclosure should be able to be changed, cleaned, and disinfected easily (Rossi, 2006; De Vosjoli, 2009). A dilute bleach solution consisting of one-half cup bleach to one gallon water can be used for cleaning purposes, provided that all surfaces are thoroughly rinsed with water before being placed back in contact with the ball python.

**Feeding:** Ball pythons are carnivorous constrictors that consume their prey whole. Mice and rats are the most readily available food sources in the pet trade. Food items should be approximately the same width as the widest part of the snake's body. Newborn ball pythons, therefore, will eat "fuzzy" or "hopper" mice, and adult ball pythons can eat adult mice or small rats (Sutherland, 2005). Young or wild-caught ball pythons may refuse to eat mice and rats initially but may recognize gerbils as a natural food source. Because ball pythons rely in part on olfaction to identify prey, gerbils can be rubbed on thawed mice or rats to scent the food items prior to offering them to the snake (Mitchell, 2004; Bays *et al.*, 2006). This will encourage the python to accept the more affordable and readily available food item.

Snakes should always be fed freshly killed or frozen-thawed prey items (Figure 2). Live rodents can inflict severe injury to a snake through biting and scratching and may cause the snake to become fearful and refuse that food item at subsequent feedings (Mitchell, 2004; Bays *et al.*, 2006). Prey items can be purchased frozen or can be humanely euthanatized by cervical dislocation (Mitchell, 2004). If dead prey is refused, live prey can be used to scent the thawed food item until the individual will readily accept dead prey.

Growing ball pythons should be fed once weekly. Adult ball pythons (those over three years of age) typically need to eat only once every two to four weeks, depending on the size



**Figure 2.** Frozen prey items are readily available at pet product retailers and online. "Fuzzy" mice are most appropriate for small, juvenile ball pythons. Adult mice are most appropriate for sub-adult or adult ball pythons.

of the food item, the time of year, and reproductive activity. Sedentary snakes that are fed too frequently are prone to obesity and constipation (Mitchell, 2004). Reproductively active snakes should be fed at least once weekly for several weeks before and after breeding. This is especially important for females, who will commonly refuse food until oviposition (Ross and Marzec, 1990). Additionally, heavier females have been found to produce a greater number of viable eggs compared to females of the same age with a lower body mass (Morrill *et al.*, 2011).

**Supplements:** No vitamin or mineral supplements are thought to be required for ball pythons. It is sufficient to offer whole prey, as long as the mouse or rat has a good body condition, does not appear to be obese or diseased, and is not decomposing.

**Grooming and handling:** Ball pythons are generally amenable to handling. Regular handling (daily to weekly) will allow the snake to become more comfortable with human contact. The snake should be supported with both hands at all times, with one hand supporting the front half of the snake and the other supporting the back half. Handling should be avoided during ecdysis (see below) and for at least 24 h after feeding, to reduce the risk of regurgitation.

Snakes will periodically shed their skin. Prior to shedding, a snake's eyes will become cloudy and develop a blue haze. During this time, its vision is impaired, which can cause agitation, aggression, and increased risk of injury from live prey. Therefore, it is best not to handle or attempt to feed the snake until it has shed its skin. The period of cloudiness will last for several days. Once the eyes have cleared, the snake will typically shed its skin within one to three days (Fitzgerald and Vera, 2006).

Reptiles and their prey items can spread *Salmonella* spp. and other pathogens; thus, it is critical that the handler wash his/her hands after each contact with a reptile or its prey. Furthermore, snakes should not be kept or handled in areas where food is prepared or where humans bathe. Also, it is strongly recommended that the handler wash his/her hands



in between handling prey and working with the python, to wash away any scent that may cause it to mistake the handler's hand for food.

## COMMON MEDICAL ISSUES

**Anorexia:** Ball pythons can be particularly difficult to feed, and it is not uncommon for individuals to refuse food for months (Rowland, 2011). Anorexia can be a response to seasonal or artificial changes in photoperiod, a consequence of inappropriate temperature or humidity, or a sign of systemic illness. Anytime significant changes in feeding habits are noted, a veterinary examination is warranted. Diagnostic testing and treatment should be based on the findings of a thorough physical examination and discussion of husbandry.

**Dysecdysis:** Every snake should shed its skin in a single piece. When the skin is shed in multiple pieces, or when unshed skin remains adhered to the snake, the animal's environment should be closely evaluated. First, one should ensure that adequate humidity is being provided. Next, one should confirm that a large enough water source is available for soaking and that smooth, solid surfaces are available within the enclosure to help the snake safely shed its skin as it rubs against them (Rowland, 2011). If husbandry is adequate and skin is still not shed properly, an underlying disease process should be considered.

Every shedding cycle should include shedding of the spectacles or eye caps, the clear epidermal layer overlying each eye. One should check each shed skin for confirmation that the eye caps have been shed or should monitor the eyes for signs of dryness, cloudiness, or for apparent build-up of layers of skin. If spectacles are retained over the snake's eye, the python should be soaked in shallow lukewarm water for several minutes each day until the eye caps fall away. If the eye caps do not shed after several periods of soaking, a veterinarian may apply an acetylcysteine (20% Acetylcysteine solution, USP; Hospira, Inc., Lake Forest, IL) or saline solution to the eye and gently, manually remove the retained spectacle with a cotton-tipped applicator or cellophane tape (Fitzgerald and Vera, 2006). Wrinkled spectacles are commonly observed in ball pythons. Although they are not "normal," they do not typically require treatment. Wrinkling of the spectacle should not be confused with dysecdysis. Attempted removal of a wrinkled but not retained spectacle could result in significant injury to the eye.

**Respiratory disease:** A ball python with respiratory disease will typically exhibit an increased respiratory rate and effort, may elevate its head or stretch its neck, and may discharge serous, mucoid or mucopurulent debris from its mouth and/or nares. If any or all of these signs are seen, husbandry should be evaluated, diagnostic testing should be performed (e.g., complete blood counts, serum biochemistries, bacterial/fungal/viral testing, radiography, endoscopy), and treatments should be selected based on the diagnostic test results. It is important to note that medications are unlikely to have a complete or lasting effect if husbandry deficiencies are not corrected. Abnormally low temperatures hinder metabolism of medication, as well as suppress the immune system of snakes (Murray, 2006; Rowland, 2011).

Respiratory infections typically affect both the lower and upper airways of ball pythons. Mucociliary clearance is poor in snakes; thus, an oral or nasal infection can easily spread to the lower airways. Infections can be bacterial, viral, fungal, or parasitic in nature. Bacterial infections typically involve Gram-negative bacteria, such as *Pseudomonas* spp., *Aeromonas* spp., and *Salmonella* spp. (Murray, 2006). Most viral causes are not specifically known, although ophidian paramyxovirus is one viral pathogen proven to be associated with respiratory disease (Murray, 2006; Rowland, 2011). Fungal and parasitic infections are much less commonly diagnosed but should be considered in cases where bacterial or viral agents are ruled out or where treatment does not lead to complete resolution of clinical signs.

**Parasites:** Although one may expect the parasite burden of a wild-caught snake to be higher than that of a captive-bred snake, all newly acquired ball pythons should be routinely checked for both ecto- and endoparasites, regardless of their origin. Ticks should be removed and killed immediately. Topical insecticides should be used when necessary, with dose, type, and frequency to be determined by a veterinarian. Fecal samples should be evaluated by direct examination and flotation for protozoans, nematodes, trematodes, and cestodes. Individuals should be medicated with antiparasitics as needed, based on results of this testing. If a mite infestation is identified in any snake, all housing, cage furniture, and conspecific snakes should be treated. Housing and cage contents can be cleaned with diluted bleach. To create the solution, dilute one-half cup bleach in one gallon of water. All surfaces that were in contact with bleach should then be thoroughly rinsed with water before returning the reptile to its enclosure.

**Stomatitis:** Stomatitis or "mouth rot" is most commonly caused by bacterial organisms, although underlying husbandry problems, self-trauma, viral infection, or other systemic diseases may predispose snakes to this disease. Stomatitis is diagnosed whenever ulcerations, irritation, bleeding, or drainage are present in the mouth or on the labial scales. It should be treated with topical, systemic, or a combination of antimicrobials based on the results of culture and sensitivity testing. Husbandry changes should be made as needed. Analgesia and additional diagnostic testing also may be necessary (Sutherland, 2005; Mehler and Bennett, 2006; Rowland, 2011).

**Trauma:** Captive ball pythons are most likely to experience trauma from thermal burns and rodent bites (Mitchell, 2004; Rowland, 2011). Thermal burns can occur when captive snakes have direct contact with a heating source. "Hot rocks" are most frequently associated with this type of trauma, although direct contact with a heating bulb or ceramic heater, or indirect contact with an under-tank heater, can all result in thermal burns. Bite trauma can occur when a live prey item is offered to a captive snake. To prevent trauma, snakes should never be allowed to directly contact a heating source, and they should never be offered live prey or be fed in groups.

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